Case Study: How NASA Expanded its Innovation Framework to Find New Solutions to Old Problems

A radio frequency engineer from rural New Hampshire contributed the best solution to a public challenge issued by NASA's Space Life Sciences Directorate. This is a clear example of what Aneesh Chopra, the US Federal Chief Technology Officer, describes as "the notion that in our society, knowledge is widely dispersed. And if it's widely dispersed, how do we capture the insights from the American people?"

Chopra later said, to a live audience at the 2010 Rethinking Government event: "A semi-retired radio frequency engineer was able to share his idea about how to solve this problem, and it so blew away other ideas that NASA said it exceeded their requirements! No complicated RFP, the need for lobbyists, some convoluted processes, etc. Just a smart person who was paid a modest fee for his insight."

Motivation for Change

In 2005, NASA had to make choices about how to support the Constellation Program, an ambitious human space exploration program, which would ultimately take humans back to the moon for months at a time. This ambitious program is designed to eventually take man to Mars, where mission durations will extend for more than two years, requiring unprecedented approaches to preparation and planning in exchange for a wealth of understanding about both space and basic survival.

"We experienced a 45% reduction in R&D budgets during the process of getting Constellation up and running," reports Dr. Jeff Davis, the Director of NASA's Space Life Sciences Directorate (SLSD). "We knew those resources weren't coming back and we thought to ourselves, we can't get this done by just doing 45% less, we need to approach this whole program in a new way."
Realizing they must redefine their program within this potentially fatal resource constraint, Jeff and his team (some 160 civil servants and 800 contractors) set about opening their minds to new ways of imagining work, resourcing, and even innovation itself.

"Early the next year, in 2006, we ran a visioning exercise that outlined four possible future scenarios – we selected the one that focused on forming alliances to leverage our internal work. We then wrote a strategic plan in 2007 and conducted a benchmark study focused on forming alliances. In our study, we found that alliance forming organizations routinely scored high in measures of their ability to produce innovations."

After this scenario exercise and subsequently taking a course at Harvard Business School entitled "Leading Change and Organization Renewal" (LCOR), the SLSD began its pursuit of open innovation in earnest. To begin, the SLSD reviewed the gaps in its research and development portfolio, and ran a portfolio mapping exercise designed by Prof. Gary Pisano at Harvard Business School on "the four ways to collaborate."

Davis admits, “We had pretty complete coverage in the quadrant labeled ‘hierarchical and closed’ – but we quickly learned that if we wanted to close the gaps in our total innovation program, we needed to better leverage external innovation platforms.”
"It was a thorough process of defining our entire body of work, evaluating which pieces we wanted to keep inside versus outside, defining gaps, and finally assessing which innovation model (mall, community, elite, or consortium) made sense for each gap area. But you have to take it that seriously, and do the homework or you’ll miss opportunities. This has been a 4-year journey for us. Then, in 2010, the Office of Management and Budget published guidance on using prizes to stimulate innovation, and we realized our efforts were aligned with an overall strategy of the Federal government.”

Davis and his team had become aware of InnoCentive through the LCOR course at Harvard, and shortly thereafter NASA began a pilot program with InnoCentive Inc. (one of three overall that included Yet2.com and TopCoder), the Waltham-based innovation marketplace, to run seven “high-value challenges” that NASA felt would benefit from the “innovation mall” model of open collaboration.

579 Solvers from all around the world took a close look at the “Data-Driven Forecasting of Solar Events” challenge on InnoCentive’s website. The problem was finding a suitable method to more reliably predict the solar particle storms originating with solar events. These storms contain energetic and ionized particles and can represent a radiation exposure hazard to spacecraft and astronauts above the protection of the earth’s atmosphere. They also have the more terrestrial consequence of impacting weather. Some 14 solvers ended up submitting complete, proposed solutions. After reviewing the submissions, NASA issued a success award to Bruce Cragin, a semi-retired radio frequency engineer.

Cragin earned his BS in Engineering Physics and his PhD in Applied Physics. He has 15 years experience in plasma physics basic research and another 13 years of industrial experience as an Radio Frequency engineer. He’s also a licensed PE in Michigan.
The challenge was “right in the ‘sweet-spot,’” Cragin said, “Though I hadn’t worked in the area of solar physics as such, I had thought a lot about the theory of magnetic reconnection. Also, the image analysis skills I acquired in the 1980’s, while looking into something called the ‘small comet hypothesis,’ turned out to be very useful.” As with many novel ideas, the fusion of skills and specific experiences allowed Cragin to see the problem and propose a solution that had escaped others focused primarily on the discipline of solar physics.

And as Cragin “daisy-chains” these cross-disciplinary approaches, he notes that the work he did on the NASA challenge, “focused my attention on predictive modeling. That led to another challenge involving maize genetics to which I also submitted a solution, and became a finalist. The computational tools acquired in that work are now being applied in two additional challenges, both genetics-related.”

Taking Control of the Future of Innovation at NASA

“Our challenge owners—the NASA employees who write, run, and evaluate our challenges—are converts and advocates of open innovation because they get good results,” reports Dr. Jennifer Fogarty, Space Life Sciences Innovation Lead.

Jeff Davis, who is leading this transformation, didn’t always find the going easy. Many of those who prospered under an old framework of innovation emerged initially as skeptics. How can you solve a solar physics problem without years of steeping in solar physics research and study? However, the fruits of this effort are becoming increasingly apparent to his organization, and to NASA as a whole. Leaders like Davis are doing as much to map the frontiers of innovation as they are to map the frontiers of space. In Davis’ own words, “Other disciplines in NASA are now considering conducting challenges based on our experience. Our experiences with open innovation have created an opportunity for us to be thought leaders in this practice; our early experiences show that open innovation is faster and more cost-effective than some traditional problem-solving tools. We’re now working on a decision framework to determine how newer and older problem-solving methods work best together. And, there’s a real element of fun and participation to it. It changes how you think.”